DNV·GL

Certificate No:
P-15056
File No:
771.91
Job Id:
262.1-012821-1

TYPE APPROVAL CERTIFICATE

This is to certify:

That the Ballast Water Management System

with type designation(s)
Bawat™ BWMS

Issued to
Bawat A/S
Værløse, Denmark

is found to comply with
Resolution MEPC.174(58)
Det Norske Veritas' Rules for Classification of Ships
DNV Type Approval Program No.771.91

Application :

This is to certify that the Ballast Water Management System listed above has been examined and tested in accordance with the requirements of the specifications contained in Guidelines contained in Resolution MEPC.174(58) and DNV Rules stated above. This Certificate is valid only for the Ballast Water Management System referred to above.

This Certificate is issued on behalf of the Danish Maritime Authority and Danish Nature Agency.

This Certificate is valid until **2018-12-31**.
Issued at **Høvik** on **2015-01-05**

DNV GL local station: **Copenhagen**

Approval Engineer: **Andreas Cappelen**

for **DNV GL**

Digitally Signed By: Sæle-Nilsen, Dag
Location: DNV GL Høvik, Norway
Signing Date: 2015-01-05

Dag Sæle-Nilsen
Head of Section

Type and model designation

Bawat Ballast Water Management System

Place of production: Bawat A/S Værløse, Denmark

Equipment /assembly drawings

Type	Description	Drawing no.	Rev.
Generic Piping and Instrumentation Diagram	BAWAT Ballast Water Treatment System	BD 2014.010	A
Design Guidelines and Operational Sequences	Installation description	BD 2014.007	D

Product description

Heat treatment and oxygen stripping by N_2 injection in a circulation process.

Treatment sequence:

- No treatment during ballast water uptake or discharge
- In-voyage ballast water circulation: heat treatment and oxygen stripping

Application/Limitation

Parameter	Reference to PID	Minimum Value
Holding time [1]	--	75 sec.
Treatment temperature [2]	+02-BT05	72°C
N_2 flow [Nm^3/h] [4]	+01-QV01	8% of circulation flow [m^3/h]
O_2 residual tank value [3]	+02-BO01	1.5 mg/L
Recirculation factor [5]	--	5

The Bawat Ballast Water Management System has been tested in marine salt water and brackish water.

Temperature and salinity of the water is not a limiting condition for the ballast water management system.

The BAWAT BWMS control system is designed to warn the operator if the ballast water temperature in the ballast tanks exceeds 50 °C.

Operational specifications for the different components

Holding tank/ circulation pump capacity [1]
The BAWAT BWMS is required to have a holding tank or equivalent arrangement with a volume to meet circulation flow multiplied by required holding time, defined by this certificate.

Heat source [2]
The BAWAT BWMS is required to have heat exchangers designed in accordance with document "Design Guidelines and Operational Sequences version D", in order to provide a temperature after holding tank of at least 72°C.

Deoxygenation [3]
The BAWAT BWMS is required to reduce the concentration of dissolved oxygen content to below 1.5 mg/L using N_2 injection.

Jet Nozzles
The ballast tanks shall be equipped with jet nozzles between each web frame in the ballast tank, designed in accordance with document "Design Guidelines and Operational Sequences version D".

Nitrogen Generator [4]
The BAWAT BWMS requires the use of N_2 for oxygen stripping in the ballast water. The flow capacity of nitrogen [Nm^3/h] must be ≥ 8% of recirculation flow [m^3/h].

Recirculation factor [5]
The number of circulations required for treatment shall be calculated after "Design Guidelines and Operational Sequences version D". Recirculation factors below 5, implies that the water in the ballast tank is not treated in accordance with this certificate.

PC
The control and montitoring unit is connected to a PC for control. The PC shall be a part of the documentation related to the specific installation. The PC shall be type approved by DNV GL or carry documentation to prove compliance with DNV Standard for Certification No. 2.4 (April 2006).

Sensors
The BAWAT BWMS must be installed with a water flow meter, nitrogen flow meter, water pressure sensors, a gas pressure sensor, O_2 sensor, and water temperature sensors according to "Generic Piping and Instrumentation Diagram, Rev. A".

Information regarding the selected components shall be part of the documentation related to the specific installation, either by a reference to valid type approval certificate or technical documentation.

Control equipment
The type approved system includes the following control unit(s):

Name	Model	Software revision
Control Monitoring Unit (CMU)	CMU 1.0	1.0

All changes in software are to be recorded as long as the system is in use onboard. The records of all changes are to be forwarded to DNV for evaluation and approval.
Major changes to the software are to be approved before installed in the computer.
A Certification of Application Functions may be required for the particular vessel.

Documents approval

The following documentation is to be submitted for approval in each case.

- Piping and Instrumentation Diagram (P&ID) of the ballast system including the circulation loop
- Power supply arrangement
- An overview of all controlled and monitored points (I/O list)
- Description confirming the arrangement of alarms for bypass of the BWMS system
- Heating arrangements
- Detail drawings of ballast tanks
- Description confirming the circulation factor for each tank

Tests carried out

- Land-based testing in accordance with Resolution MEPC.174(58)
- Shipboard testing in accordance with Resolution MEPC.174(58)
- Factory acceptance test of the control and automation system witnessed by DNV
- Testing in accordance with environmental test specification for instrumentation and automation equipment, DNV Standard for Certification No. 2.4 (April 2006) and Resolution MEPC.174(58)

Testing parameters for the land-based and shipboard tests are described in the summary final test reports following this certificate.

Type Approval documentation

- Performance evaluation in land based test facility of BAWAT ballast water management system – Draft Quality Assurance Project Plan, dated 2012-10
- Performance evaluation in land based test facility of BAWAT ballast water management system – Quality Assurance Project Plan dated 2013-03
- Performance evaluation in land based test facility of BAWAT ballast water management system – Quality Assurance Project Plan dated 2014-01
- Performance evaluation in land-based test facility BAWAT A/S, Final Report, dated September 2014
- Quality Management Plan and Quality Assurance Project Plan for shipboard tests of BAWAT BWMS V5.2, dated 2013-08-09
- Quality Management Plan and Quality Assurance Project Plan for shipboard tests of BAWAT BWMS V9.1, dated 2014-05-08
- Reports regarding shipboard tests of the Bawat Ballast Water Treatment system for Type approval according to regulation D-2 and the relevant IMO Guideline (G8)
- Software design specification SDS Bawat A/S, V02, dated 2014-09-22
- FAT procedure, V06, dated 2014-09-16
- Functional Specification (FS), V04, dated 2014-09-22
- Design Guidelines and Operational Sequences, rev. D, doc no. BD2014.007
- Bawat BWMS Software Revision Practice Rev. 2, doc no. SP10, dated 2014-10-21
- Bawat BWMS Operation, Maintenance and Safety Manual, rev. E, doc no. BD 2014.006
- Test for Marine Type Approval of BAWAT CMU 1.0 for Ballast Water Treatment System, report number DANA-19/14449, dated 2014-09-01
- Treatment of Ballast Tank Water in different scales -modeling of the ballast tank, and experimental validation of the model, Jakob K. Huusom and John Villadsen, dated 2014-01
- Bawat BWMS Assessment of applicability for G9, dated 2012-05-30
- Note on Ballast Water Tank Compartments, Jakob K. Huusom and John Villadsen, dated 2014-10

Marking of product

For traceability of this type approval, each treatment system is to be marked with:

- Manufacturer's name or trade mark
- Type designation
- Serial number

Periodical assessment

For retention of the Type Approval, DNV GL Surveyor shall perform periodical assessments to verify that the conditions of the TA are not altered since the certificate was issued.

The scope of periodical assessment includes:

- Review of the TA documentation and verification that the documentation is still used as basis for the production.
- Review of possible changes in design, material and performance of the product.
- Verification of the conpanys production and quality systems ensuring continued consistent production of the type approved products to the required quality.
- Verification that the product marking for identification and traceability to the TA Certificate is not altered.

Copy of type approval certificate

A copy of this type approval certificate should be carried onboard a vessel fitted with this ballast water management system at all times. An annex containing the summary reports of the test results of land-based and shipboard tests should be available for inspection onboard the vessel.